ARCHER CSE Service Quarterly Report

Quarter 2 2018

1. Document Information and Version History

Version:	1.0
Status	Release
Author(s):	Andy Turner, Lorna Smith, David Henty, Chris Johnson, Jo Beech-Brandt
Reviewer(s)	Lorna Smith, Alan Simpson

Version	Date	Comments, Changes, Status	Authors, contributors, reviewers
0.1	2018-06-08	Skeleton document	Andy Turner
0.2	2018-06-26	Added Centralised and eCSE sections	Chris Johnson, Andy Turner
0.3	2018-06-26	Initial set of CSE outputs	Andy Turner
0.4	2018-06-27	Annual survey review	Lorna Smith
0.5	2018-06-29	Added stats CSE outputs	Andy Turner
0.6	2018-07-03	Updated Training Section Feedback	David Henty
0.7	2018-07-06	Finalised stats and outputs	Jo Beech-Brandt
0.8	2018-07-13	Reviewed	Alan Simpson
1.0	2018-07-15	Version for EPSRC	Alan Simpson

2. Executive Summary

This report covers the period: 1 April 2018 to 30 June 2018 inclusive.

- Centralised CSE Team:
  - We have published a report comparing the performance of applications on different UK HPC systems and providing advice for users in choosing the best HPC system for their research. This work was in collaboration with the University of Cambridge. See: https://github.com/hpc-uk/archer-benchmarks/blob/master/reports/initial_comparison/index.md
  - We have worked with the Cray Centre of Excellence to obtain a data feed of parallel I/O statistics for all jobs run on ARCHER, and have started work to incorporate this data into SAFE to allow users to gain insights of how they use I/O on the ARCHER service.
  - We have analysed the responses to the 2017 ARCHER Annual User Survey and identified a number of opportunities for service improvement based on the responses. The analysis and identified actions are available at the end of this report.
- Training:
  - We delivered 19 days (479 student-days) of face-to-face training in the quarter at 6 different locations, with an average feedback score better than "Very Good".
  - Following on from the success of the online MPI course in Q1, we delivered a new online course in "Modern C++ for Computational Scientists" spread over two Wednesday afternoons. This was very successful with around 30 attendees, and we now plan to run a 2-day face-to-face version next year.
  - To assess the longer-term benefit of the training programme to users, we wrote a report on the Fifth Training Impact Survey and circulated this to EPSRC and the ARCHER Training Panel.
- eCSE:
  - All 90 projects awarded over the 12 eCSE calls issued have started, with 76 of these having now been completed. The remaining projects are all planned to finish by 31 October 2018. Of those completed, 64 final reports have been received, 55 of which have been reviewed.
  - The eCSE13 call was opened on 5 June 2018 and closes at 4pm on the 17 July 2018. Projects selected at this call will run between 1 October 2018 and the expected end of the ARCHER service, 18 November 2019.
- Outreach:
  - The fifth ARCHER Champions was held in Manchester in conjuction with the SSI "Impact of ARCHER" event. It was well attended and plans are in place to continue this as "HPC Champions" with a newly formed organising committee from the HPC community.

3. Collaborations and Outputs Summary

- Presentations:
  - Leveraging SLEPc in modeling the earth's magnetic environment, **Nick Brown**, Brian Hamilton, William Brown, Ciaran D Beggan, Brian Bainbridge, Susan Macmillan, EASC 2018, 17-19 April 2018, Edinburgh, UK
  - Accelerating simulations of cerebrovascular blood flow through parallelization in time, **Rupert Nash**, David Scott, Daniel Ruprecht and Derek Groen, EASC 2018, 17-19 April 2018, Edinburgh, UK
  - In-flight ensemble processing for exascale, Jeff Cole, Bryan Lawrence, Grenville Lister, Yann Meursdesoif, **Rupert Nash**, and Michèle Weiland, EASC 2018, 17-19 April 2018, Edinburgh, UK
  - TPLS: A Freely Available Program for the Simulation of Two Phase Flow, Lennon Ó Náraigh, Prashant Valluri, **David Scott**, PETSc '18 User Meeting, 4-6 June 2018, Imperial College, UK
- Posters:
  - Investigating Software Implications of Emerging HPC Hardware for Parallel IO, **David Henty** and Elsa Gonsiorowski, Impact of international collaborations in research software (SSI workshop), 24 April 2018, Manchester, UK
- Meetings:
  - UK RSE Committee Meeting, **Andy Turner**, 16 April 2018, Microsoft Research, Cambridge, UK
  - ARCHER RAP Meeting, **Andy Turner**, 1 May 2018, EPSRC, Swindon, UK
  - eCSE 11-09 collaboration meeting, **Rupert Nash**, **David Scott**, Derek Groen, Daniel Ruprecht, 16 May 2018, University of Leeds, UK
  - Tier-2 Directors' Meeting, **Andy Turner**, 25 May 2018, London, UK
  - HEC Chairs' Meeting, **Andy Turner**, 25 May 2018, London, UK
  - CarpentryCon 2018, **Andy Turner**, 29 May – 1 June 2018, UCD, Dublin, Ireland
  - UK RSE Committee Meeting, **Andy Turner**, 13 June 2018, Institute of Physics, London, UK
- Papers:
  - Modelling fracture in heterogeneous materials on HPC systems using a hybrid MPI/Fortran coarray multi-scale CAFE framework, Advances in Engineering Software, A. Shterenlikht, L. Margetts, **L. Cebamanos,** Advances in Engineering Software,, https://doi.org/10.1016/j.advengsoft.2018.05.008
  - PolNet: A Tool to Quantify Network-Level Cell Polarity and Blood Flow in Vascular Remodeling, Miguel O.Bernabeu, Martin L.Jones, **Rupert W. Nash**, AnnaPezzarossa, Peter V.Coveney, HolgerGerhardt, Claudio A.Franco, Biophysical Journal, https://doi.org/10.1016/j.bpj.2018.03.032
  - Modeling Patient-Specific Magnetic Drug Targeting Within the Intracranial Vasculature, Alexander Patronis, Robin A. Richardson, Sebastian Schmieschek, Brian J. N. Wylie, **Rupert W. Nash** and Peter V. Coveney, Frontiers in Physiology https://doi.org/10.3389/fphys.2018.00331

4. Forward Look

- Centralised CSE Team:
  - We are putting together a joint project with the Cray Centre of Excellence to investigate performance variation on the Lustre parallel file systems on ARCHER. This will provide users and the service with insights to improve the efficient use of ARCHER. It should also provide useful input into any future national HPC procurements.
  - We are working with Tier-2 RSE groups to setup a UK HPC workshop day associated with the RSE2018 conference in Birmingham in September 2018.
  - We are setting up a benchmarking collaboration with both GW4 and HEC BioSim RSE groups to coordinate benchmarking efforts across different HPC systems in the UK and to share best practice and experience.
- Actions from Annual Survey review:
  - We will review and update the policy, documentation and processes associated with CSE central software installations to ensure they continue to meet the requirements of the user community.
  - We will schedule webinars focussing on debugging and profiling tools and techniques to help the user community get the most out of their software on ARCHER.
  - We will work with Tier-2 centres and HPC/ARCHER Champions to raise the profile of the opportunities on offer to get access to different HPC technologies through the national Tier-2 resources.
- Training:
  - With the expected extension of the ARCHER contract, we are now planning courses up to the end of 2018 (previously only covered the first three quarters).
  - We are running the first instance of the new “HPC Carpentry” course in Leeds in July. This uses the novel, interactive training methods developed in the Software and Data Carpentry courses to teach the basic concepts of HPC to new users.
  - We are in discussion with the Alan Turing Institute about running more courses at their London headquarters in the coming year. This takes some coordination as it has to be synchronised with their Researcher Training Programme, but the ATI is a very convenient venue for users so it is worth considering.
  - Following on from the success of the online MPI course in Q1, we are considering running an online OpenMP course in Q4 using the same format.

5. Contractual Performance Report

This is the contractual performance report for the ARCHER CSE Service for the Reporting Periods: April 2018, May 2018 and June 2018.

The metrics were specified by EPSRC in Schedule 2.2 of the CSE Service Contract.

CSE Query Metrics

- **QE1:** The percentage of all queries notified to the Contractor by the Help Desk in a Quarter that the Contractor responds to, and agrees a work plan with, the relevant End User within 3 working hours of receiving the notification from the Help Desk. *Service Threshold: 97%; Operating Service Level: 98%.*
- **QE2:** The percentage of all queries notified by the Help Desk to the Contractor that have been satisfactorily resolved or otherwise completed by the Contractor within a 4-month period from the date it was first notified to the Contractor. *Service Threshold: 80%; Operating Service Level: 90%.*
- **TA1:** The percentage of all technical assessments of software proposals provided to the Contractor by the Help Desk in any Service Period that are successfully completed by the Contractor within 10 days of the technical assessment being provided to the Contractor by the Help Desk. *Service Threshold: 85%; Operating Service Level: 90%.*
- **FB1:** The percentage of End User satisfaction surveys for CSE queries carried out in accordance with the Performance Monitoring System by the Contractor showing the level of End User satisfaction to be "satisfactory", "good" or "excellent". *Service Threshold: 30%; Operating Service Level: 50%.*

Period	Apr-18		May-18		Jun-18		Q2 2018	
Metric	Perf.	SP	Perf.	SP	Perf.	SP	Perf.	Total
QE1	100%	-2	100%	-2	100%	-2	100%	-6
QE2	100%	-2	100%	-2	88%	0	96%	-4
TA1	100%	-1	100%	-1	100%	-1	100%	-3
FB1	100%	-2			100%	-2	100%	-4
Total		-7		-5		-5		-17

Pink – Below Service Threshold
Yellow – Below Operating Service Level
Green – At or above Operating Service Level

QE2 was below Operating Service Level in June 2018 due to a single In-Depth query taking longer than 4 months to resolve. As the number of queries in a period is low (9 queries in June 2018), a single query has a large impact on statistical measures. In this case, the query topic was the installation of a C++ application that had a large number of scientific library dependencies and a complex build system. The CSE team worked on the installation in collaboration with the user and the application developers, and completed the build so the user was able to run their research on ARCHER. The blank entry for FB1 in May 2018 is due to no feedback being provided by users in this month.

Training Metrics

- **FB2:** The percentage of all training satisfaction surveys carried out in accordance with the Performance Monitoring System by the Contractor) in each Quarter that are rated "good", "very good" or "excellent". *Service Threshold: 70%; Operating Service Level: 80%.*

Period	Apr-18		May-18		Jun-18		Q1 2018	
Metric	Perf.	SP	Perf.	SP	Perf.	SP	Perf.	Total
FB2	100%	-1	100%	-1	100%	-1	100%	-3
Total		-1		-1		-1		-3

Pink – Below Service Threshold
Yellow – Below Operating Service Level
Green – At or above Operating Service Level

Service Credits

Period	Apr-18	May-18	Jun-18
Total Service Points	-8	-6	-6

6. CSE Queries

Queries Resolved in Reporting Period

Metric Descriptions

In-Depth	All technical queries passed to ARCHER CSE team
Course Registration	Requests for registration on ARCHER training courses
Course Enquiry	Enquiries about courses
Technical Assessment: <Category>	Request for Technical Assessments of applications for ARCHER time
eCSE Application	Queries relating to eCSE applications

A total of 266 queries were resolved by the CSE service in the reporting period.

Metric	Apr-18	May-18	Jun-18	Total
Course Registration	72	81	39	192
eCSE Application	1	5	0	6
In-Depth	6	10	8	24
Course Enquiry	2	3	5	10
Technical Assessment: Grant	4	6	9	19
Technical Assessment: Instant	3	4	2	9
Technical Assessment: RAP	6	0	0	6
Total	**94**	**109**	**63**	**266**

3 query feedback responses were received on In-depth queries in the reporting period. This represents a 13% return rate for feedback forms. All 3 responses registered a score of "Excellent". We continue to try to improve the response rate for feedback from queries by offering charity donations for responses and sending additional reminders to users to provide feedback.

Resolved In-Depth queries fell into the following categories:

Category	Number of Queries	% Queries
3rd party software	16	66.7%
Compilers and system software	2	8.3%
Porting	2	8.3%
Data transfer	1	4.2%
Disks and resources	1	4.2%
User programs	1	4.2%
Performance and scaling	1	4.2%
Total	**24**	**100.0%**

In-Depth Query Highlights

A small number of In-Depth queries have been selected to illustrate the work of the centralised CSE team over the reporting period.

Q869529 Deal_II 8.5.0

An ARCHER user wanted to install a geodynamics application, ASPECT. This application requires the deal.II 8.5.0 C++ finite element framework which has a complex set of dependencies that need to be available and understood by the build system. The CSE team worked in collaboration with the user to solve the complex issues with getting this up and running on ARCHER. Access to the CSE expertise on making libraries and build systems work with the Cray XC architecture provided the user with the information required for them to compile this complex framework

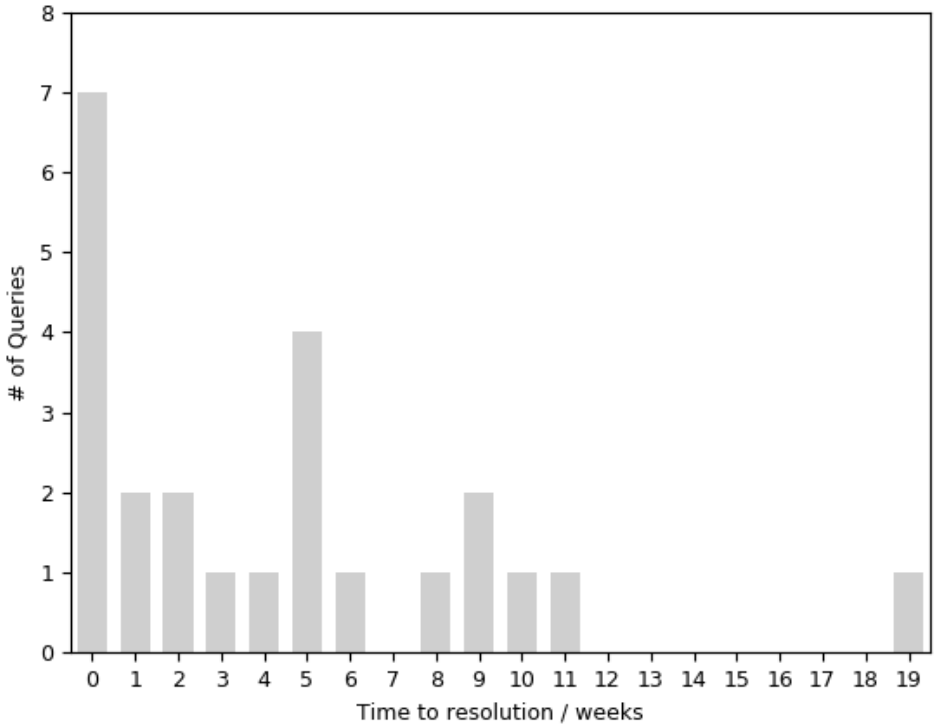
and move forward with their research. Once the software was successfully installed the user and CSE team worked together to add the build and configure instructions to the central ARCHER repository of build instructions to help future users of this framework: https://github.com/ARCHER-CSE/build-instructions/tree/master/deal.II.

Q994927 HDF5 library version problems with python-netCDF4 output

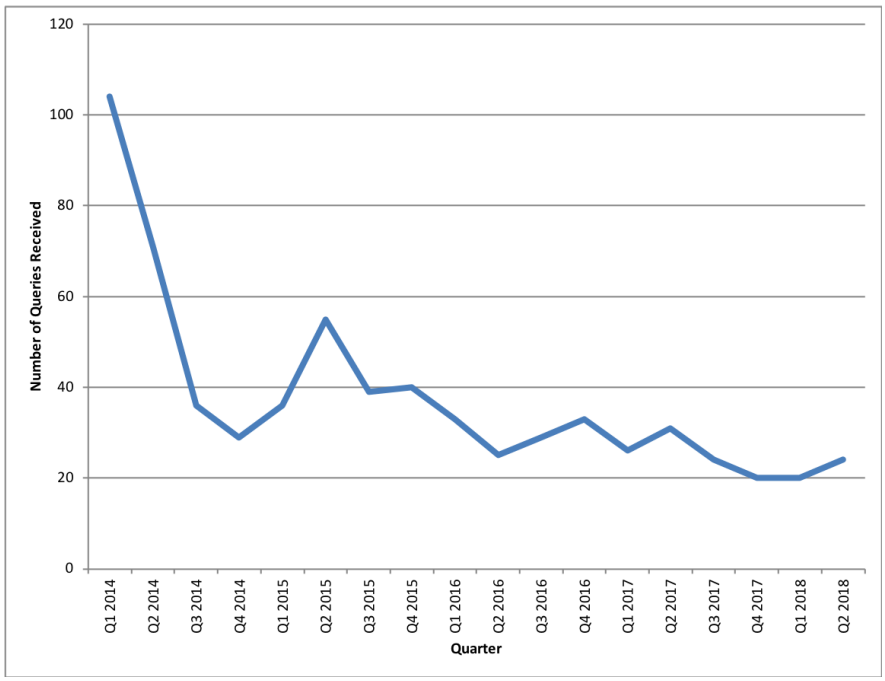
A user was seeing issues with reading NetCDF files written by their Python analysis script. The CSE team identified two issues and provided fixes. Firstly, the way in which the Python script worked was affected by the order in which software modules were loaded and the CSE team provided the correct ordering to allow the script to work. Secondly, the user wanted to use the Ferret tool to manipulate the NetCDF files, but the error persisted with this tool when the module ordering was changed. The CSE team determined that the version of NetCDF used when compiling Ferret was leading to the problems and provided updated build instructions to the user to create a version of Ferret that could be used to manipulate their NetCDF files successfully and continue with their work on ARCHER.

In-Depth Query Analysis

The histogram below shows the time to resolution for In-Depth queries in the current reporting period. The median resolution time during this period is 4 weeks (median resolution time since 1 Jan 2014 is 2 weeks).

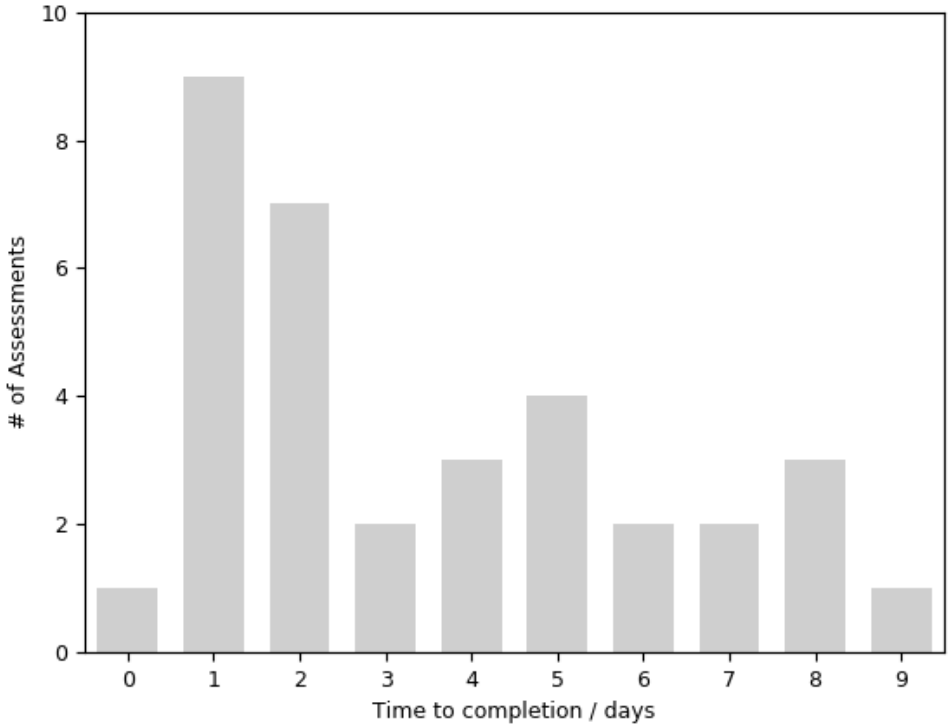


Plot of numbers of In-Depth queries received per quarter:

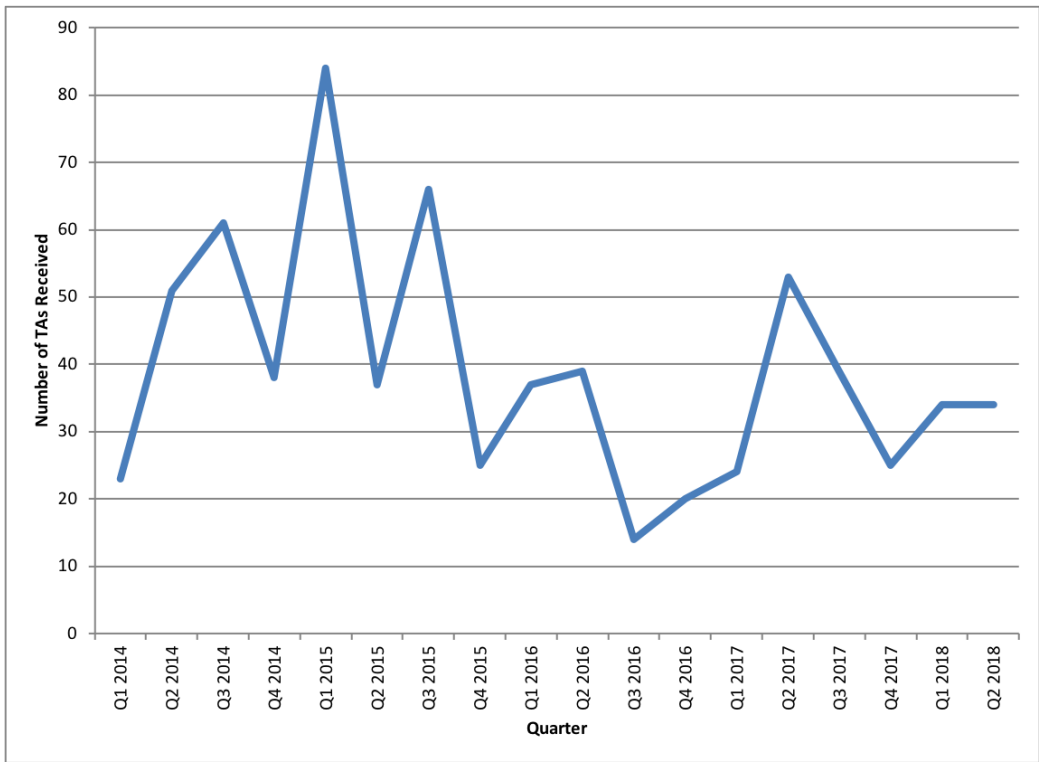


Technical Assessment Analysis

A histogram of the time to completion for Technical Assessments (see below) reveals that the median completion time for this quarter was 3 days (median completion time since 1 Jan 2014 is 3 days).



Plot of numbers of Technical Assessments received per quarter:



7. Centralised CSE Team: Strategic Priorities Progress

In collaboration with user groups and the other Service partners, the CSE service identified several priority areas to invest technical effort from the centralised CSE team. This section summarises progress in the reporting period in these areas.

Comparing UK HPC systems

The first report comparing the performance of different Intel Xeon-based HPC systems in the UK has been published along with advice for researchers on choosing the best HPC system for their work. The report can be found online at:

https://github.com/hpc-uk/archer-benchmarks/blob/master/reports/initial_comparison/index.md

and can be referenced using the following Digital Object Indentifier (DOI):
http://doi.org/10.5281/zenodo.1288378

We have also highlighted the open source nature of this benchmarking work to the HPC-SIG and RSE communities and this has led to a number of people wishing to contribute more widely to the benchmarking effort. In addition to these offers from the community, we are currently in discussions with the GW4 RSE team about linking our benchmarking with the work they have been doing on Arm processors and with the HEC BioSim RSEs on their work looking at the performance of biomolecular applications across CPU and GPU architectures. We plan to coordinate with these two groups in the future to provide the best quality benchmark data and advice for users.

As well as expanding the range of architectures and applications covered by the benchmarking effort, we also plan to expand the range of systems covered to include some systems in the DiRAC service. In particular, we will evaluate the performance of the Extreme Scaling system at the University of Edinburgh that uses the Intel Xeon Skylake Silver processors to provide information that will help inform future HPC procurements.

Machine learning performance on different architectures

Building on the open source work that we have carried out comparing performance of traditional HPC applications across different HPC systems, we are working to define a set of machine learning (ML) benchmarks to compare performance of different architectures for these types of workload that are becoming more prominent in UK research. We plan to focus on the use of ML on datasets that struggle to fit within memory on a single node of current systems as this use is becoming more and more important in areas such as medical research, and requires researchers to use remote advanced computing resources such as those provided by ARCHER, DiRAC and the Tier-2 HPC systems.

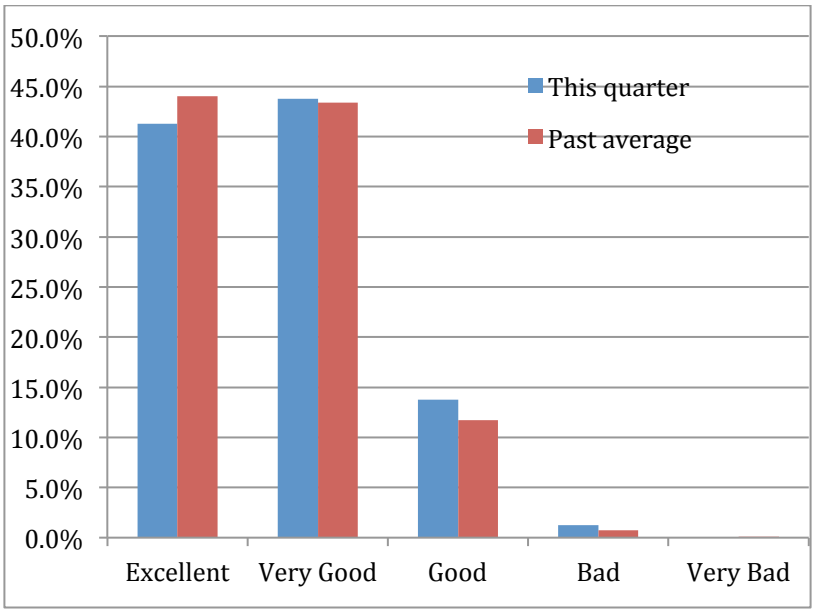
8. Training

This quarter, the CSE Service has provided a total of 19 days (479 student-days) of face-to-face training across 6 different locations and 2.0 days of interactive online tutorials (average attendance 23 per tutorial).

Month	Dates	Course	Location	Days	Attendees
Apr 2018	11-13	Message-Passing Programming with MPI	Soton	3	37
	18	HPC-Europa: EC-funded collaborative HPC visits	Online	0.5	
	26-27	Advanced MPI	Exeter	2	13
May 2018	10-11	Hands-on Intro to HPC	Edinburgh	2	28
	16	Cray Programming Environment Update	Online	0.5	
	17-18	Scientific Programming with Python	London	2	18
Jun 2018	13	C++ for Computational Scientists	Online	0.5	
	18-19	Software Carpentry	London	2	20
	19-22	CP2K Workshop	Daresbury	3*	31
	19-21	Performance Analysis Workshop	London	3	17
	20-21	Data Analytics with HPC	Belfast	2	33
	27	C++ for Computational Scientists	Online	0.5	

* This course ran from lunchtime to lunchtime so is counted as just 3 days.

On the feedback for face-to-face courses, attendees rate the course on a scale of 1-5 ("Very bad", "Bad", "Good", "Very good" and "Excellent"). The average feedback using this metric was 4.3, i.e. better than "Very Good". Users provided 80 feedback forms, a response rate of 41%.



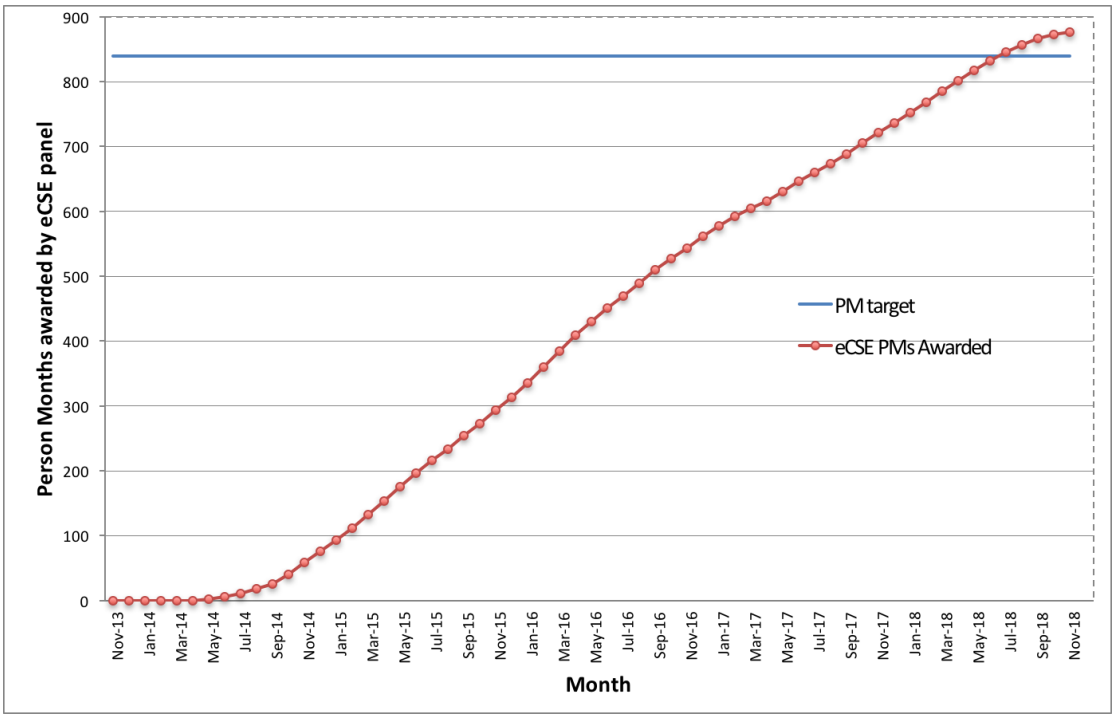
We received one overall score of "Bad". The attendee entered their personal information and stated that they were happy to be contacted, so we are currently following this up to get more detailed information on the reason for this.

16 days of face-to-face training are planned for the third quarter of 2018, plus 1.5 days online.

Month	Dates	Course	Location	Days	Attend
Jul 2018	2-3	Hands-on Intro to HPC	Edinburgh	2	
	4-6	Message-Passing Programming	Edinburgh	3	
	11	TBC	Online	0.5	
	17-19	Advanced OpenMP	Cambridge	3	
	25-26	HPC Carpentry	Leeds	2	
	30-31	Advanced MPI	Milton Keynes	2	
Aug 2018	8	TBC	Online	0.5	
Sep 2018	12	TBC	Online	0.5	
	13-14	Shared-Memory Programming with OpenMP	London	2	
	20-21	Data Carpentry	Swansea	2	

9. Embedded CSE (eCSE)

Overview of eCSE effort



- The eCSE person months awarded up to and including the 12th eCSE call are shown in red.
- We committed to awarding at least 840 person months by November 2018 (14 FTEs for 5 years).
- 881 person months have been awarded so far over 90 awarded eCSE projects meaning an extra 41 person months were awarded at the final call.

eCSE call	No. proposals	No. projects awarded	No. person months awarded	No. projects started	No. projects completed	No. final reports received	Notes
eCSE01	19	14	132	14	14	14	
eCSE02	17	9	82	9	9	9	
eCSE03	16	10	96	10	10	9	1 late final report is being pursued.
eCSE04	16	8	82	8	8	8	
eCSE05	14	8	94	8	8	8	
eCSE06	9	5	47	5	5	5	
eCSE07	16	5	49	5	5	4	1 late final report is being pursued.
eCSE08	21	8	88	8	8	5	2 late final reports are being pursued. The final report for the remaining completed project is due in early Q3.
eCSE09	19	5	62	5	4	1	1 project completed early due to a staff member leaving and a final report is being pursued (see risk list

							below). Final reports for the remaining 2 completed projects are due in early Q3.
eCSE10	13	6	59	6	1	0	The final report for the one completed project is due in early Q3.
eCSE11	18	6	49	6	4	1	Final reports for the remaining 3 completed projects are due in mid Q3.
eCSE12	23	6	41	6	0	0	
Total	**201**	**90**	**881**	**90**	**76**	**64**	

- A risk analysis identified all projects as being of either low or very low risk apart from the following which were identified as being of medium risk:
    - eCSE04-10: the PI indicated that the person named to do the technical work may not be available
        - This project went ahead with the original staffing. There was a short delay to the start of the project which started on 01/01/16. The project is now complete and we have now received the final report. This will be reviewed shortly.
    - eCSE08-9: this project had a change of staffing
        - The new staff member was approved by the panel chair and the project has now finished. The project is now complete and we have now received the final report. This will be reviewed shortly.
    - eCSE09-6: this project has terminated early after the recent death of Dr Karl Wilkinson who was one of the Co-Is together with the fact that the researcher doing the work resigned from his current post in Cambridge in November 2018
        - The PI confirmed that the first work package is likely be completed and the project used half its allocated effort. Given the circumstances we agreed to this early termination and the unused funds were used to award eCSE12 projects at the final panel meeting. We have requested a final report to describe the work carried out but this has not yet been received.
    - eCSE09-8: this project was awarded 19 person months. This is a higher level of effort than awarded for other eCSE projects where 15 person months is the highest level of effort awarded so far
        - Of the 19 months awarded for this project, 7 were for a member of the ARCHER CSE team and the remaining 12 were for an external member of staff at the PI's institution. This project is now complete and the final report is due in Q3.
    - eCSE10-5: a change of staffing is required
        - We have discussed this with the PI and have agreed the project has been scaled back and re-staffed but will monitor the situation via regular contact with the PI. The unused funds were used to fund eCSE12 projects at the final panel meeting.
    - eCSE12-20: the project runs right up until 30/9/2018 – almost the end of the CSE contract
        - the project will be monitored via regular contact with the PI.

eCSE technical report DOIs and ARCHER community on Zenodo

We now encourage all PIs/Co-Is/report authors to acquire a DOI (Digital Object Identifier) for their eCSE technical report(s). This will help to make the eCSE technical reports more discoverable and citable. As required by a number of the eCSE PIs/Co-Is/report authors, the eCSE team will help them to deposit their eCSE technical reports into the open data repository,

Zenodo, and will acquire the DOIs for their technical reports. The DOIs will be added on the individual report webpage of each eCSE project on the ARCHER website.

Zenodo (https://zenodo.org) is a research data repository hosted by CERN, which is funded by European Commission via OpenAIRE projects, CERN, Alfred P. Sloan Foundation and Donations via CERN & Society Fonndation. Contents with any format from all fields of research can be uploaded into Zenodo free of charge. A new community for ARCHER is planned to be created on Zenodo. The new ARCHER community on Zenodo can be used not only for the eCSE technical report collections, but also for any other ARCHER documentation, training materials, datasets, etc.

10. ARCHER Annual User Survey: CSE Review

The ARCHER annual user survey is aimed at understanding the views of users of the current ARCHER service. It seeks feedback looking for areas that are working well and for areas of improvement. The survey measured user satisfaction across a range of areas, with scores from 1 (representing "Very Unsatisfied" to scores of 5 ('Very Satisfied"). The results are shown in the table below.

Service Aspect	2014 Mean Score (out of 5)	2015 Mean Score (out of 5)	2016 Mean Score (out of 5)	2017 Mean Score (out of 5)
Overall Satisfaction	4.4	4.3	4.3	4.4
Hardware	4.1	4.1	4.2	4.3
Software	4.0	4.0	4.2	4.1
Helpdesk	4.5	4.5	4.5	4.6
Documentation	4.1	4.1	4.2	4.2
Website	4.1	4.2	4.2	4.2
Training	4.1	4.1	4.2	4.1
Webinars	3.6	3.9	3.9	4.2
Online training	-	4.0	4.1	4.2

164 users responded and overall the service has again had very positive feedback, with all areas gaining scores between 4 and 5. There has also been a slight increase in the overall satisfaction rating from 2016, going up from 4.3 to 4.4. Many users provided additional comments, and these are listed in full in the User Survey.

Documentation and Website As with other aspects overall satisfaction was high for these, with a mean of 4.2 for both Documentation and the Website. Looking at the feedback, multiple users commented on package accounts, highlighting the importance of these to the community. In addition to positive comments concerning the on-line documentation and the speed of release updates, a small number looked for improvements. The service is therefore looking at reviewing and enhancing the process of creating and managing package accounts, including communication and documentation.

Action: Produce policy for CSE central software installation.
Action: Review documentation for central CSE software.
Action: Review process for CSE central software installation.

Training Again, training had a high overall satisfaction rating, with a mean of 4.1. The only score below 3 was reported with a comment that the user had not attended any training. Webinars and On-line training had a lower response rate than other parts of the survey, but show a high satisfaction rating, with a mean of 4.2. The mean rating for Webinars has increased significantly over the years (from 3.6 in 2014). We have introduced new webinar software which is entirely browser based and simpler and easier to utilise. This, coupled with a new style of on-line training through the live on-line MPI course, has, we believe, contributed to this rating increase.

A number of users commented on profiling and debugging tools, looking for additional information on these. We are therefore looking at running a set of webinars on the different profiling and debugging tools, together with a set of online videos.

Action: Schedule webinars on debugging and profiling tools and techniques.

Hardware and Software Overall satisfaction is again high for both hardware and software. Looking at the user comments, a number of users are looking for greater capacity/capability, e.g. more memory, cores, etc. This is natural considering we are nearing the end of service. Some of the comments however suggest a potential lack of awareness of the opportunity to test different HPC architectures through the national Tier-2 HPC services. We will continue to work with users and other Tier-2 services to publicise Tier-2 access opportunities.

Action: Coordinate with Tier-2 centres and HPC/ARCHER Champions to raise profile of Tier-2 access opportunities to research community.